

Remarks/Arguments:

The present invention solves the problem of edge curl that can occur when forming a multi-layer electrode. Edge curl, i.e. having a concavity form in a previously flat electrode layer during baking (illustrated in figure 16F of the application), is undesirable as it makes it difficult to subsequently form additional layers, and subsequently formed dielectric layers are subject to electrical breakdown. Moreover, it solves the problem without having to resort to physical grinding of edges, or the use of multiple bake steps.

The present invention solves the edge curl problem by "pre swelling" electrode layers such that shrinkage results in flattening of a convex surface rather than resulting in a flat surface becoming a concave surface. Such "pre swelling" is accomplished by incorporating steps which promote solvent flow from regions having higher absorbency to regions having lower absorbency. Promoting appropriate solvent flow is accomplished, at least in part, utilizing multiple printing, exposure and baking steps performed in a particular order, and by drying the electrode layers by rapidly heating the layers so that an ambient temperature is increased at a rate of 10 to 40°C/min.

More particularly, the present invention involves a method having an exposure step and a dry step. In the exposure step, a difference in solvent absorbency is generated between exposed regions and unexposed regions of a photosensitive paste. In the dry step the temperature gradient is adjusted to fall within an optimum range. With such exposure and dry steps, the film thickness of the applied paste can be controlled.

This characteristic of the present invention enables, in producing an electrode having a laminated structure where a second layer is laminated on a first layer, the electrode to be formed such that, at its cross sectional shape in the width direction, the film thickness of the second layer is thicker in its middle portion than its edge portion in the width direction. As a result, in the baking step after the paste is applied, such problems as shrinkage of the electrode and coming off of the electrode from the substrate can be avoided. This enables a highly reliable metal electrode to be produced.

In contrast, *Wagenblast* seeks to provide a mechanism by which photocopies can be made without the need to use high voltage sources necessary in other electro-photographic processes. The process of *Wagenblast* involves producing a pattern of surface charges on a recording layer, "inking" the recording layer by applying liquid or solid toner to the pattern of charges, and either fixing the applied toner on the recording layer or transferring the applied toner to another surface. *Wagenblast* does not attempt to teach a new method of manufacturing electrodes, and in no way attempts to solve the problems that the invention of this application, i.e. edge curl in multilayer electrodes.

Applicant finds it hard to give any weight to an argument that the claimed invention is obvious in light of *Wagenblast*, particularly since *Wagenblast* is not directed to solving problems that occur during the formation of multi-layer electrodes, does not in fact teach anything new in regard to electrode formation, and is, in fact, directed to improvements relating to image reproduction, not electrode formation. If the rejection of the claims is maintained, it is hoped that the next Office Action will shed some light on why a person of ordinary skill in the art attempting to prevent edge curl would look to *Wagenblast* for a solution, and even if such a person did so, how a reference that does not teach the solution claimed renders the claimed solution obvious.

That being said, the following paragraphs address the inadequacies of *Wagenblast* as an obviating reference in more detail, as well as summarizing the amendments contained herein.

Claims 1-2 and 4-16 remain in this application. Claims 3, and 17-27 have been canceled. Claims 1, 2, 4 and 7 were amended herein. Claims 28-30 have been added.

Claims 1-16 were rejected as being unpatentable over *Wagenblast et al.* (US5312703, hereinafter "*Wagenblast*"). This rejection is moot at least in light of the amendments to claims 1, 2 and 7 contained herein as the cited reference does not teach, suggest, or motivate the claimed invention in that it does not teach, suggest or motivate all of the recitations of the rejected claims.

The Office Action does a good job of citing *Wagenblast* by essentially copying portions of the text verbatim, but the citations do not support the rejection of the claims. In particular, it

cites the composition of the recording layer and an image electrode layer, and the fact that the recording layer is put in contact with the image electrode layer. As the citation itself states, the image electrode layer is made in a conventional manner by etching an ITO electrode on a glass substrate and covering it with a Teflon layer. There is slightly more information given in regard to the recording layer, but all that is said is that it comprises a carrier coated with a 0.7 micron thick electrode layer that is covered with a polyimide layer formed by spin coating, drying, and baking.

Wagenblast discloses, in short, a method for forming a transparent electrode film. Specifically, the cited reference discloses a method for first forming an ITO film on a glass substrate, spin-coating, drying, and baking a polyimide precursor to form a polyimide layer, and then performing patterning by etching, thereby forming an ITO electrode film with a desired pattern.

The Office Action admits that *Wagenblast* does not specifically teach a second print, dry, and exposure step. Applicant infers from this that the Office Action views *Wagenblast* as teaching all the other elements of the rejected claims. However, I review of the recitations of the rejected claims shows that such is not the case.

Referring to claim 1, its preamble recites: "A manufacturing method for a metal electrode whose structure consists of multiple layers of one or more types of metal...." As previously discussed, *Wagenblast* does not attempt to teach a new method for manufacturing a metal electrode. Moreover, the electrodes of *Wagenblast* do not have a structure that consists of multiple layers of one or more types of metal. Instead, the electrodes in *Wagenblast* appear to consist of a single metal layer on a substrate coated with a polyimide or Teflon layer.

Claim 1 also recites: "a first print step for printing a first photosensitive substance that includes a mixture of a first metal, a photosensitive resin, and a solvent to form a first layer...." The closest that *Wagenblast* appears to come to this is the recitation of the use of the image electrode which has been etched. However, etching relates to a method of removal and does not provide any teaching as to how the electrode being etched was originally formed. The electrode could have been formed by lamination, sputtering, and or plating. Moreover, an electrode which

has been "etched imagewise" is not necessarily formed from a photosensitive substance as a non-photosensitive layer can be masked and etched to form an image.

Claim 1 also recites: "a first dry step for drying the first layer...." This recitation, when read in conjunction with the forgoing recitations is that there is a step for drying a layer made from a photosensitive substance that includes metal, photosensitive resin, and a solvent. The only drying step cited in the Office Action relates to drying of the polyimide covering layer, not the electrode layer, and thus not a layer such as is claimed.

Further review of claim 1 shows that it recites: "a first exposure step for exposing the first layer ... to form an electrode pattern. The "first layer" is one that is formed from a photosensitive substance and has already been subjected to a drying step, the exposure step is "to form an electrode pattern". In contrast, *Wagenblast* teaches subjecting an already formed electrode to electrical fields from another already formed electrode. Although that other electrode is formed by being "etched imagewise", that there is no teaching, suggestion, or motivation to form that electrode through the use of a photosensitive substance and a drying step.

Still further review shows claim 1 as reciting: "a second print step ...; a second dry step ...; a second exposure step" The Office action admits that these steps are not found in *Wagenblast*. The Office Action attempts to overcome the admitted inadequacies of *Wagenblast* by asserting that one of average skill in the art would be motivated to include the missing second print, dry, and exposure steps in order to form any specific printed circuit pattern that is within the design choice of one of ordinary skill in the art. However, as discussed above, *Wagenblast* does not teach, suggest, or motivate the first steps, so it is unlikely that steps not found would be repeated for any purpose. Looking at the reason for repeating, it is unclear why, even if the first steps were taught by *Wagenblast*, why they would have to be repeated in order to achieve the end that the Office Action asserts as a reason for doing so. Moreover, even if repeating was necessary to obtain the benefit asserted by the Office Action, it is unclear (particularly since *Wagenblast* does not teach the first steps) as to whether repetition of the steps would achieve the benefit asserted.

Claim 1 also recites: "a baking step for baking the electrode pattern to shape the metal electrode...." However, the only baking step taught by *Wagenblast* is that used in forming the polyimide cover layer and is not used "shape the metal electrode".

Despite the inadequacies already identified, in an attempt to achieve earlier allowance, Applicant has amended claims 1 and 2 to recite: "wherein in each of the second dry steps, the first layer and the second layer are dried by rapidly heating the layers so that an ambient temperature is increased at a rate of 10 to 40°C/min." As such, even if *Wagenblast* taught, suggested, and/or motivated the recitations of the rejected claims, it would fail to obviate them because it does not teach, suggest, or motivate a drying step, used in formation of electrodes, that utilizes the specified rate for increasing ambient temperature.

In regard to claims 2 and 7, in addition to the applicable arguments already provided, each claim recites a drying step that involves heating the layer to form unevenly heated regions. *Wagenblast* is silent in regard to drying that involves heating to form unevenly heated regions.

Claims 4-6 and 8-16 are all allowable at least because of their dependence on allowable base claims. Moreover, if rejection of the claims is maintained, references that teach, suggest, or motivate all of the additional recitations should be provided in order to support any such rejection.

In summary, unlike the present invention, the cited reference fails to teach a technique for drying a conductive paste (an applied film having photosensitivity and conductivity) while enabling the paste to have a desired temperature gradient, for the purpose of increasing a difference in the reduction ratio of the film thickness depending on exposed portions and unexposed portions of the applied paste. The cited reference also does not include disclosure implying such a technique.

Here, although the Office Action acknowledges that the cited reference does not disclose the exposure step defined in the present application, the Office Action contends that providing an "exposure step" is a common practice to obtain a desired pattern. As described above, however, the exposure step defined in the present application is not a simple patterning technique but a

highly sophisticated process of forming a favorable metal electrode by adjusting a film thickness of a paste. As such, the exposure step defined in the present application should never fall within the design choice of one of ordinary skill in the art.

In this respect, Applicant believes that there exists a clear distinction between the technique relating to the cited reference and the invention of the present application.

Unlike the present invention, the cited reference also fails to disclose a technique for increasing, in its middle portion, the film thickness of the paste at its cross section shape in the width direction of the electrode. Further, the cited reference never recognizes the problems solved by the present invention, namely, shrinkage of the paste or coming off of the paste in the baking step.

In this way, the cited reference neither has motivations to solve the problems recognized by the invention of the present application, nor discloses means for solving such problems. Therefore, even a skilled person in the art would never come up with a technique, from the disclosure of the cited reference, for providing an electrode having a photosensitive metal film of the present invention.

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It is believed that the case is now in condition for allowance, and an early notification of the same is requested. If the Examiner believes that a telephone interview will help further the prosecution of this case, he is respectfully requested to contact the undersigned attorney at the listed telephone number.

I hereby certify that this correspondence is being deposited with the United States Postal Service as First Class Mail in an envelope addressed to the Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on April 2, 2004.

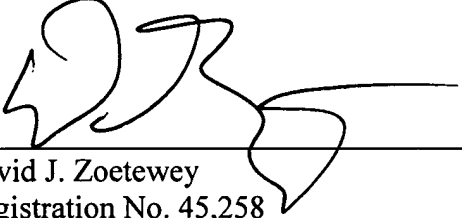
By: Sharon Farnus

Sharon Farnus
Signature

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Very truly yours,

SNELL & WILMER L.L.P.



David J. Zoetewey
Registration No. 45,258
1920 Main Street, Suite 1200
Irvine, California 92614-7230
Telephone: (949) 253-2774